

Remarks

Claims 1-20 and 22-27 were previously pending in this application. Claims 2, 21, and 23-26 are canceled without prejudice or disclaimer. Independent claims 1, 11, and 17 as well as dependent claims 4, 8, 13, and 15 are currently amended without introducing new matter. New dependent claims 28-32 are added also without introducing new matter. Support for the amendments as well as the new claims can be found throughout the application, including the claims, as originally filed.

As a result, claims 1, 3-20, 22, and 27-32 are pending for examination with claims 1, 11, 17, and 22 being independent claims.

Summary of Telephone Conference with the Examiner

Applicants thank the examiner for the courtesy of a telephonic interview on November 17, 2006. During the interview, U.S. Patent No. 6,126,805 was discussed without reaching an agreement with respect to the claims.

Rejections Under 35 U.S.C. § 103

Claims 1-3, 8-13, and 27 are rejected under 35 U.S.C. § 103(a) as being unpatentable over the teaching of Hark in U.S. Patent No. 4,808,287 (hereinafter "Hark") in view of the teaching of Batchelder et al. in U.S. Patent No. 6,126,805 (hereinafter "Batchelder").

Applicants disagree that claims 1-3, 8-13, and 27 would have been obvious over the teaching of Hark in view of the teaching of Batchelder. The rejection is improper for failing to provide a *prima facie* case of obviousness because no teaching, suggestion, or motivation has been provided for the proposed combination. Further, the alleged *prima facie* case of obviousness is defective because any proposed combination of the teachings of these references would fail to teach each and every limitation recited in these claims.

Preliminarily, Applicants disagree that a proper *prima facie* case of obviousness has been presented with respect to any of independent claims 1, 11, and 17 and the claims that

respectively depend therefrom. No competent implicit or explicit reason, suggestion, or motivation has been set forth that would explain why one of ordinary skill in the art would have modified the teaching of Hark with the teaching of Batchelder.

The examiner avers that Hark teaches a system for producing treated water but fails to teach that “the electrical current is maintained below a limiting current density to suppress hydroxyl ion generation” and that Batchelder allegedly teaches that electrodialysis treatment systems are “operated near or below the limiting current density, sometimes in combination with reversal of direction of the electric current ... to mitigate the precipitation and deposition of minerals to [sic] contact surfaces.” To support this allegation, the passages beginning at column 1, line 62 to column 2, line 19 and also at column 4, line 42 to column 5, line 2 of Batchelder were cited.

The cited passages, however, do not provide any motivation for a method of producing treated water comprising at least one act of removing at least a portion of any undesirable species from the water in the electrochemical separation device while suppressing hydroxyl ion generation or operating the electrochemical separation devices utilized in the system disclosed by Hark, at an applied electrical current below the limiting current density.

Batchelder at column 1, lines 62 to column 2, line 17 states that (with emphasis added):

In order to maximize the utilization of ED apparatus it is desirable to operate at the highest possible current densities. However as the limiting current density is approached it is found that water is dissociated (“split”) into hydrogen ions and hydroxide ions at the interfaces between the (conventional) anion exchange (“AX”) membranes and the diluting streams. The hydrogen ions pass into the diluting streams and the hydroxide ions into the adjacent solutions which are being enriched in ions (the “concentrate, concentrated, concentrating or brine solutions or streams” as known in the art). Since brackish water may often contain calcium bicarbonate there is a tendency therefore for calcium carbonate to precipitate at those surfaces of the (conventional) AX membranes which are in contact with the concentrating stream. This problem has been addressed by chemical or IX softening of the feed waters or the concentrating streams; by adding acid to the feed waters or the concentrating streams (with or without decarbonation) or by regularly reversing the direction of passage of the electric current thereby changing the concentrating streams to diluting streams (and the diluting streams to concentrating streams).

Batchelder explicitly teaches operating at the highest possible current density. Moreover, Batchelder explicitly provides solutions to address consequences when water splitting occurs,

i.e., chemical or ion exchange softening, acid addition, and reversal of the applied electric current. Thus, the cited passage of Batchelder does not teach suppressing hydroxyl ion generation or applying a current at below a limiting current density and instead explicitly promotes operating at the highest possible current densities. Therefore, a person of ordinary skill in the art, relying on this teaching, would not have been motivated to modify the system disclosed by Hark and operate any one or more of the electrochemical separation devices thereof with an applied current that is below the limiting current density, or suppress hydroxyl ion generation, but would be motivated instead to utilize pre-treatment unit operations and/or current reversing techniques to remove or inhibit scale precipitation.

At column 4, lines 42 to column 5, line 2, Batchelder states that (with emphasis added):

As noted above, when the limiting current density during electrodialysis (as measured by the Cowan-Brown method (Ind. Eng. Chem. 51, 1445, (1959)) of conventional cation exchange membranes is exceeded there is very little “splitting” of water into hydrogen and hydroxide ions. However When [sic] the Cowan-Brown limiting current density of conventional anion exchange membranes is approached or exceeded a substantial fraction of the impressed direct current is carried by hydrogen and hydroxyl ions apparently resulting from the splitting of water by the high potential gradients which exist at the interfaces between the anion exchange membranes and the liquid in the diluting compartment near and above the Cowan-Brown limiting current density. (The limiting current density for anion exchange membranes is roughly 50% greater than that for cation exchange membranes). Water splitting at polarized anion exchange membranes (that is at such membranes operating near or above the Cowan-Brown limiting current density) results in hydrogen ions passing into the liquid in the diluting compartments of an ED, EDR, EDI, EDIR stack and hydroxide ions passing into the liquid in the concentrating compartments. Since many liquids which it is desired to demineralize contain calcium and bicarbonate ions (e.g. potable water and brackish water) the passage of hydroxide ions into the concentrating compartments can result in precipitates of calcium carbonate on and/or in those surfaces of conventional anion exchange membranes which surfaces are in contact with the concentrating streams.

A plain reading of this passage also does not provide any motivation for operating an electrochemical separation device at below the limiting current density, or suppressing hydroxyl ion generation. Instead, a person skilled in the art would have been motivated to operate the device at a level above the limiting current density because when the limiting current density during electrodialysis is exceeded there is very little “splitting” of water into hydrogen and

hydroxide ions at conventional cation exchange membranes. That is, based on the averred rationale, a person skilled in the art, seeking to avoid generating hydroxyl ions so as to “limit the amount of precipitation” thereof, would operate at a current level that is greater than the limiting current density. The rest of the passage militates against operating an electrochemical separation device because, at below the limiting current density, hydroxyl ions would be generated at conventional anion exchange membranes when the limiting current density is approached. Because this passage also cannot be relied upon for providing a motivation to operate electrochemical separation devices at below the limiting current density or to suppress hydroxyl ion generation, the *prima facie* case of obviousness is improper.

To be sure, because the cited passages of Batchelder appear to teach that water splitting is unavoidable with respect to conventional anion exchange membranes, a person skilled in the art would thus be motivated to install unit operations upstream of the electrical separation device to remove precipitate-causing species, e.g., chemical or ion exchange softening; or lower the pH of the solution; or regularly reverse the applied electric current. This is notably consistent with the teaching of Hark. (See, for example, Hark at column 4, lines 48 to 50, “reverse polarity upon overvoltage requirements for the purpose of cleaning (shacking [sic] off) contaminants, which have deposited on the electrodes.”) Thus, even if the teachings of these references could have been combined, a person of ordinary skill in the art would have modified the system disclosed by Hark to incorporate the pre-treatment unit operations disclosed by Batchelder to soften the water or operate the electrochemical separation device by applying a periodically reversed electrical current at above the limiting current density to, as the examiner suggests, “further limit the amount of precipitation occurring on the EDI surfaces.”

Moreover, independent claim 1 would not have been obvious over the combined teachings of the references because Hark and Batchelder fail to teach or suggest a method of producing treated water comprising at least one act of introducing water from a point of entry into a reservoir system and an electrochemical device. Dependent claims 3-10, which depend directly or indirectly from independent claim 1, also would not have been obvious over the combined teachings of Hark and Batchelder for at least the same reasons discussed above. Further, with respect to dependent claims 4-7, neither reference teaches a method of producing

treated water comprising at least one act of measuring at least one water property of water in the reservoir system.

Independent claim 11 would not have been obvious over the combined teachings of the references because Hark and Batchelder fail to teach or suggest a method of producing treated water comprising acts of introducing water from a point of entry into a reservoir and introducing a portion of the water from the reservoir into an electrochemical separation device. Dependent claims 12-16 and 27, which depend directly or indirectly from independent claim 11, also would not have been obvious over the combined teachings of these cited references for at least the same reasons discussed above.

Likewise, independent claim 17 would not have been obvious over the teaching of Hark in view of the teaching of Batchelder because the references fail to teach or suggest a water treatment system comprising a reservoir system fluidly connected to a point of entry wherein the reservoir comprises a plurality of zones having water contained therein with differing water quality levels. For at least the same reasons, dependent claims 18-20 and 28-29 would not have been obvious over the teachings of Hark in view of the teachings of Batchelder.

Independent claim 22 and dependent claim 30 also would not have been obvious over the teachings of Hark and Batchelder because the references fail to teach or suggest a method of facilitating water treatment comprising providing a pressurizable reservoir system fluidly connectable downstream of a point of entry and upstream of a distribution system and further providing an electrochemical device that is fluidly connected downstream of the pressurizable reservoir system.

Dependent claims 4-7 are rejected as being unpatentable under 35 U.S.C. § 103(a) over the teaching of Hark in view of the teaching of Batchelder and further in view of the teaching of Rela in U.S. Patent No. 6,607,668 (hereinafter "Rela").

Dependent claims 4-7 would also not have been obvious over the teaching of Hark in view of the teachings of Batchelder and Rela. Dependent claims 4-7 depend from independent claim 1. As noted above, no proper *prima facie* case of obviousness has been set forth that would have motivated a person of ordinary skill in the art to combine the teachings of Hark and Batchelder. Rela likewise fails to provide any teaching, suggestion or motivation to incorporate the teaching of Batchelder into the system disclosed by Hark. Further, no teaching, suggestion or

motivation has been set forth that would support a *prima facie* case of obviousness for the combined teachings of Hark, Batchelder, and Rela.

Even if the teachings of the references could have been combined, dependent claim 4-7 would still not have been obvious because the resultant combination would fail to recite each and every limitation in independent claim 1 since none of the references teach a method of producing treated water comprising introducing water from a point of entry into a reservoir system and an electrochemical device.

Accordingly, reconsideration and withdrawal of the rejection under 35 U.S.C. § 103 is respectfully requested.

New Claims 28-32

Newly presented dependent claims 28-32 respectively depend from independent claims 1, 11, 17, and 22. Support for these claims can be found throughout the specification, claims, and drawings as originally filed. These claims are also patentable for at least the same reasons noted above.

Conclusion

In view of the foregoing Amendments and Remarks, this application is in condition for allowance; a notice to this effect is respectfully requested. If the examiner believes that the application is not in condition for allowance, the examiner is requested to call Applicants' attorney at the telephone number listed below.

If this Response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicants hereby request any necessary extension of time. If there is a fee occasioned by this response, including an extension fee that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 50/2762.

Respectfully submitted,
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